REMARKS

The application has been amended and is believed to be in condition for allowance.

Previously, claims 1-8 were pending. These claims have been amended. Claims 9-20 have been added. New claims 9-10 comprise subject matter canceled from original claim 1. New claims 11-20 are based on claims 1-10.

The Official Action objected to the originally filed claims under §112, second paragraph, as indefinite.

The claims have been amended so as to remedy the stated basis of rejection.

Withdrawal of the indefiniteness rejection is solicited.

Claims 1-8 stand rejected as anticipated by AGRAWALA et al. 4,183,013.

A review of the present invention is warranted.

The present invention relates to a method for extracting feature quantities of image data. See specification page 1. In particular, the extracting method is capable, in a single scan, to extract the scanned image's area, a circumferential length, end point coordinates, coordinates of the center of gravity, a second moment, etc.

With reference to specification page 6, the inventor has found that such image data can be extracted properly and smoothly for each scanned image area by scanning binary image data that is

to be displayed in one frame. A setting is so made that when a pixel having a prescribed density is detected, in scanning one line of the image data, the content of each of a pixel immediately preceding the detected pixel on the same line and a pixel that is on an immediately preceding line and right above the detected pixel is checked, and that an area number of one image area is inherited when the detected pixel belongs to the same image area as one of the above pixels.

Advantageously, the invention extracts the feature quantities by a single scan.

Figure 1 shows a data structure for each image area having feature quantities extracted. The data structure is a memory format used for storing feature quantities of image data (an area, a circumferential length, end point coordinates, center of gravity coordinates, and a second moment of each image area An). That is, for an image area An, shown in Figure 1, the data structure is headed by an image area effectiveness flag. Feature quantities of image data are arranged in order of an area, a circumferential length, a top point x coordinate, a top point y coordinate, a bottom point x coordinate, a bottom point y coordinate, a left end point x coordinate, a left end point y coordinate, a right end point x coordinate, a right end point y coordinate, the sum of x's, the sum of y's, the sum of x*x's, the sum of y*y's, and the sum of x*y's.

Next, the inventive method will be described.

In a scan of one line of image data, ***if*** a black pixel An is detected, as shown in Figure 2, ***then*** the image area that the subject pixel An belongs to is determined by

i) checking a pixel An-1 that immediately precedes the pixel An on the same line and

ii) checking a pixel An+1 that is located on the immediately preceding line and right above the pixel An.

If neither pixel has an image area, a new image area A1 is generated. In Figure 2, note that both the checked pixels are white pixels, i.e., not black pixels, and image area A1 is generated.

In contrast, consider Figure 3. In a scan of one line of image data, as shown in Figs. 3(a)-3(c), the pixel An-1 immediately preceding the subject pixel An and/or the pixel An+1 right above the subject pixel An is checked and what image area each pixel belongs to is determined.

If the pixel An-1 immediately preceding the subject pixel An has an image area A2, the subject pixel An inherits the image area A2 at its side (see Fig. 3(a)).

Alternatively, if the pixel An+1 right above the subject pixel An has an image area A2, the subject pixel An inherits the image area A2 located right above (see Fig. 3(b)).

If the pixel An-1 immediately preceding the subject pixel An and the pixel An+1 right above the subject pixel An have image areas A1 and A2, respectively, the subject pixel An inherits

the image area A2 of the pixel An+1 right above the subject pixel An with priority given to it (upwardness priority; see Fig. 3(c)).

As disclosed above, there are four different situations and results explained.

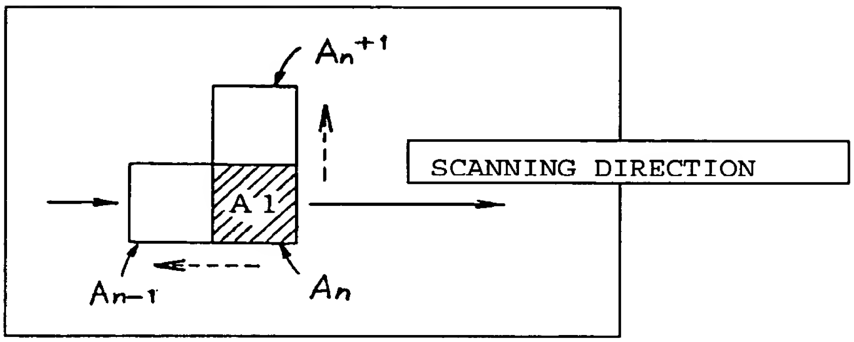
Each pixel of a line is sequentially scanned. When a scan of one line of image data has finished, there may be a case that consecutive image areas have different area numbers as shown in Figure 4(a). In this case, to combine the image areas, the line buffer is scanned in the reverse direction. Then, as shown in Fig. 4(b), where all the pixels adjacent to each other are caused to belong to the same image area (A2 or A4) and the image areas to be used for the data processing for feature quantities are combined with each other.

In view of the above, consider amended claims 1-2.

Claim 1 recites:

A) in scanning one line of image data, when a detected pixel has a prescribed density, checking an image area content of each of a first pixel immediately preceding the detected pixel on the one line and a content of a second pixel that is on an immediately preceding line and right above the detected pixel to determine, based on the image area content, if the detected pixel belongs to an image area of the first pixel or an image area of the second pixel;

In Figure 2, the detected pixel does not belong to the image area of either the first pixel (An-1) or the second pixel (An+1):

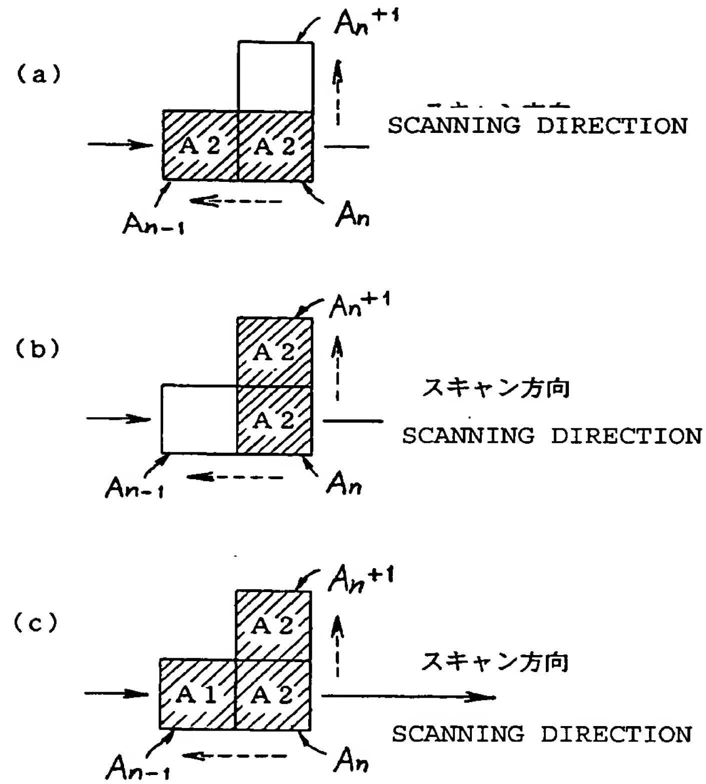


Claim 1 also recites:

B) when the detected pixel belongs to the image area of the first pixel or the image area of the second pixel, having the detected pixel inherit an area number of the image area of the first pixel and the second pixel to which the detected pixel belongs;

In Figure 3(a), the detected pixel belongs to the image area of the first pixel; in Figure 3(b), the detected pixel belongs to the image area of the second pixel; and in Figure 3(c), the detected pixel belongs to the image areas of both the first and the second pixel.

[FIG. 3]



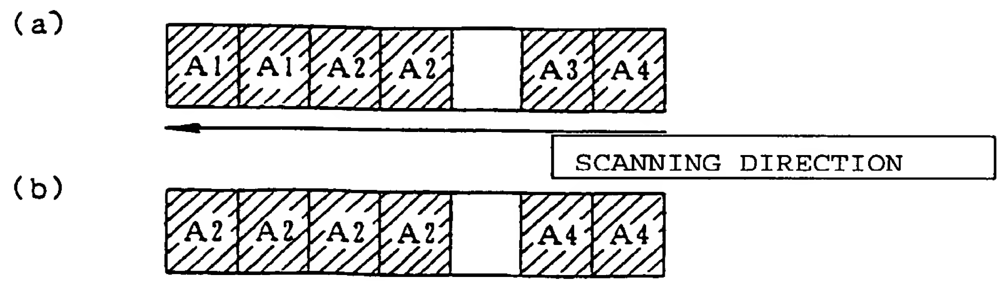
Next, claim 1 recites:

C) performing the above processing steps A)-B) sequentially on succeeding pixels to store resulting image data in a line buffer;

D) after the scanning of the one line has been completed, scanning the line buffer in a reverse direction and modifying the image area content of consecutive pixels having different area numbers to have a same area number when the consecutive pixels belong to respective image areas but have different area numbers.

Figure 4 illustrates the recitations of step D):

where the consecutive pixels having different area numbers have been modified to have the same area number, e.g., A2 and A4 for the two groups.



Claim 2 recites, wherein, when step A) determines that the detected pixel belongs to both the image area of the first pixel and the image area of the second pixel, having the detected pixel inherit the area number of the image area of the second pixel right above the detected pixel.

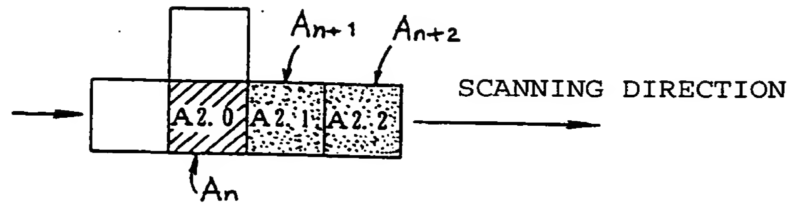
The claim 2 recitation corresponds to Figure 3(c).

Attention is next directed to the disclosure beginning on specification page 15. It is there disclosed that it is effective to regard, as belonging to the same image area, image areas that do not satisfy the above conditions of combining and are distant from each other by several pixels. This is disclosed as being necessary for image data of "dot marking," "blurring," or the like.

Consider two image areas that are distant from each other by N pixels, e.g., two pixels (N = 2), are connected to each

other to form the same area with the two adjacent pixels regarded as belonging to respective semi-image areas.

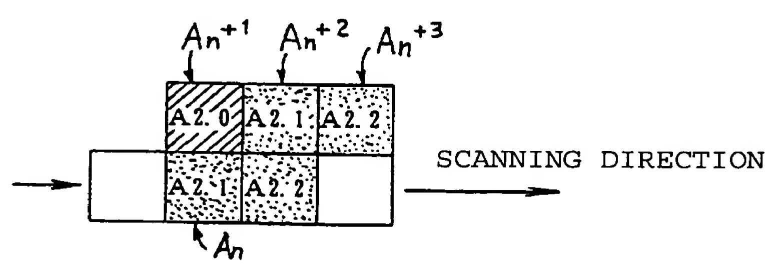
[FIG. 5]



As shown in Fig. 5, after generation of an image area A2.0 at a subject pixel An, semi-image areas A2.1 and A2.2 (N = 2) are generated at the two following pixels An+1 and An+2 and distance information is stored in the line buffer together with the information of the image area A2.

Similarly, if the pixel An+1 right above a subject pixel An has an image area A2.0, inheritance is made with semi-image areas A2.1 and A2.2 generated at two pixels adjacent to each other, that is, the subject pixel An and the immediately following pixel An+1, respectively. See Figure 6:

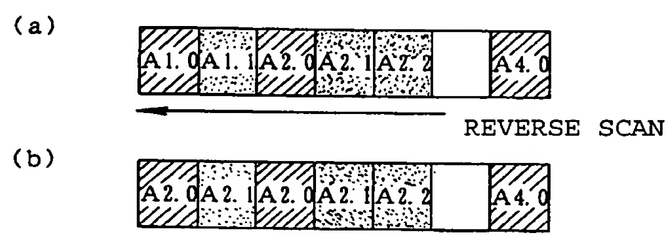
[FIG. 6]



See (Figure 5) that performing a scan of the one line of the image data relating to pixel An identify 2 pixels (N=2)

that follows the first image area having a prescribed first area number that has just terminated (An=A2.0), the N pixels forming semi-image areas adjacent the first image area. In Figure 6, there is shown another example. See claim 4.

If consecutive image areas have different area numbers as shown in Fig. 7(a), the line buffer is scanned in the reverse direction and adjacent pixels are caused to belong to the same area (or its semi-image areas) as shown in Fig. 7(b) with a common area number.



See that Figures 7(a)-7(b) illustrate reverse direction and modifying the different area numbers to a common area number after identifying consecutive pixels belong to respective image areas and semi-image areas but having different area numbers. That is A1.0 and A1.1 in Figure 7(a) are modified to be A2.0 and A2.1 in Figure 7(b). See claim 5.

Thus, the invention provides a method for extracting feature quantities of a binary image (area, circumferential length, end points, center of gravity, and moment of an image area) by scanning image frame data one line at a time. When a pixel having a prescribed density is detected in scanning one line

of image data, that pixel is checked against a content of each of a pixel immediately preceding the detected pixel on the same line (recited as the first pixel) and a pixel that is on an immediately preceding line and right above the detected pixel (recited as the second pixel). The detected pixel inherits an area number of the image area of the first and/or second pixel, when the detected pixel belongs to the same image area as one of the first and second pixels. The invention includes scanning the line buffer in a reverse direction and modifying the different area numbers to the same area number for consecutive pixels belonging to respective image areas but have different area numbers. In this manner, an area, a circumferential length, end point coordinates, center of gravity coordinates, a second moment, etc. can be extracted properly and smoothly for each image area by scanning binary image data only once.

AGRAWALA et al. do not disclose the recited features of the invention.

Applicant does not see where AGRAWALA et al. disclose a step where A) in scanning one line of image data, when a detected pixel has a prescribed density, checking … .

Where is the teaching of meeting a condition of prescribed density in a detected pixel causing a checking action? That is, upon a pixel meeting a prescribed density, the checking action is taken.

Attention is directed to column 9, beginning at line 44 disclosing a change in objects, i.e., a new hole object appearing for the first time in line k is identified when a boundary does not continue as per FIG. 5A. See in Figures 5A-5B and 6A-6B, that the teaching is to scan the entire line to determine object boundaries.

The analysis disclosed by AGRAWALA et al. is to measure the old (previous) line and the new (current) line, and based on the two line measurements, to modify the different area numbers. See, beginning at line 59, "On detecting the condition for creation of either a new hole or body object, the object boundary resolver and identifier 14 defines the corresponding left and right edge points …, or …, to be resolved. See that these points along the entire line are determined before the resolver acts.

The teaching here is not the recited, i.e., that when a detected pixel has a prescribed density, checking "an image area content of each of a first pixel immediately preceding the detected pixel on the one line and a content of a second pixel that is on an immediately preceding line and right above the detected pixel to determine, based on the image area content, if the detected pixel belongs to an image area of the first pixel or an image area of the second pixel."

Claim 1 also recites "D) after the scanning of the one line has been completed, scanning the line buffer in a reverse direction and modifying the image area content of consecutive

pixels having different area numbers to have a same area number when the consecutive pixels belong to respective image areas but have different area numbers."

Applicant does not see that AGRAWALA et al. make this teaching.

The Official Action has pointed to Figure 13, element 13 for this recitation. The relevant disclosure is that "FIG. 13 illustrates the object boundary resolver and identifier 14 and the timing and sequence control portion 20b of controller 20. The object boundary resolver and identifier 14 includes a pair of buffered scan line memories 74 and 76, boundary resolution logic 78, branching logic 80 and pointer network 82. The pointer network 82 is illustrated in more detailed form in FIG. 14, and, similarly, the boundary resolution logic 78 is illustrated more fully in FIG. 15. The object boundary resolver and identifier 14 further includes continuation logic 84, creation logic 86, termination/merge logic 88, object stack 90, and object memory 92."

There is no disclosure here of "scanning the line buffer in a reverse direction and modifying the image area content of consecutive pixels having different area numbers to have a same area number when the consecutive pixels belong to respective image areas but have different area numbers."

There is no teaching a reverse scanning by AGRAWALA et al.

As to claim 2, AGRAWALA et al. do not teach "when step A) determines that the detected pixel belongs to both the image area of the first pixel and the image area of the second pixel, having the detected pixel inherit the area number of the image area of the second pixel right above the detected pixel." Specifically, there is no teaching as to the second pixel (the pixel of the previous line) having priority. See that claim 2 makes clear that the first pixel and the second pixel belong to different image areas, as illustrated by Figure 3(c) of the application and discussed above.

Also see that claims 11-12 make clear this priority relationship.

Claim 11 recites "checking an image area content of ***only*** each of a first pixel immediately preceding the detected pixel on the one line and a content of a second pixel that is on an immediately preceding line and right above the detected pixel to determine, based on the image area content, if the detected pixel belongs to a first image area of the first pixel or a second image area of the second pixel" and "***when the detected pixel belongs to one of the first and second image areas, having the detected pixel inherit an area number of one of the first and second image areas to which the detected pixel was determined to belong.***"

Claim 12 is specific in reciting "when step A) determines that the detected pixel belongs to both the first image area of the first pixel and the second image area of the second

pixel, ***having the detected pixel inherit the area number of the second image area of the second pixel right above the detected pixel***."

Similarly, the features of the remaining claims, e.g., claims 13-15, are not found in AGRAWALA et al.

Reconsideration and allowance of the pending claims are respectfully requested.

Should there be any reason that the case not be found in condition for allowance, it is requested that applicant's remarks be specifically addressed so that applicant can clearly understand how the claims are being read on the reference.

Applicant believes that the present application is in condition for allowance and an early indication of the same is respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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